National Ocean Partnership Program

USACE (JALBTCX) and NOAA CSC

High-level Data Fusion Software for SHOALS-1000TH

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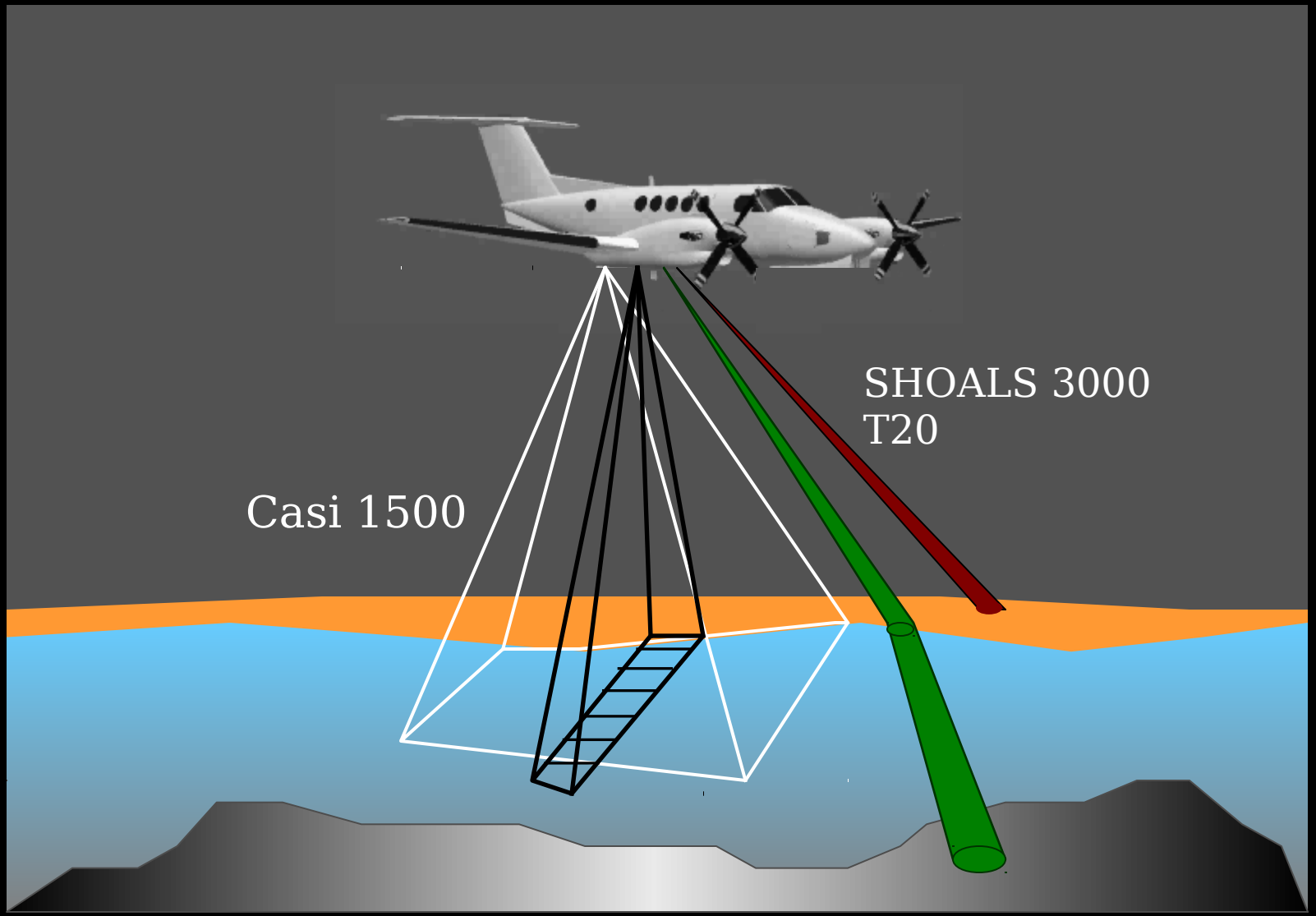
Motivation: CHARTS (SHOALS-3000-TH)



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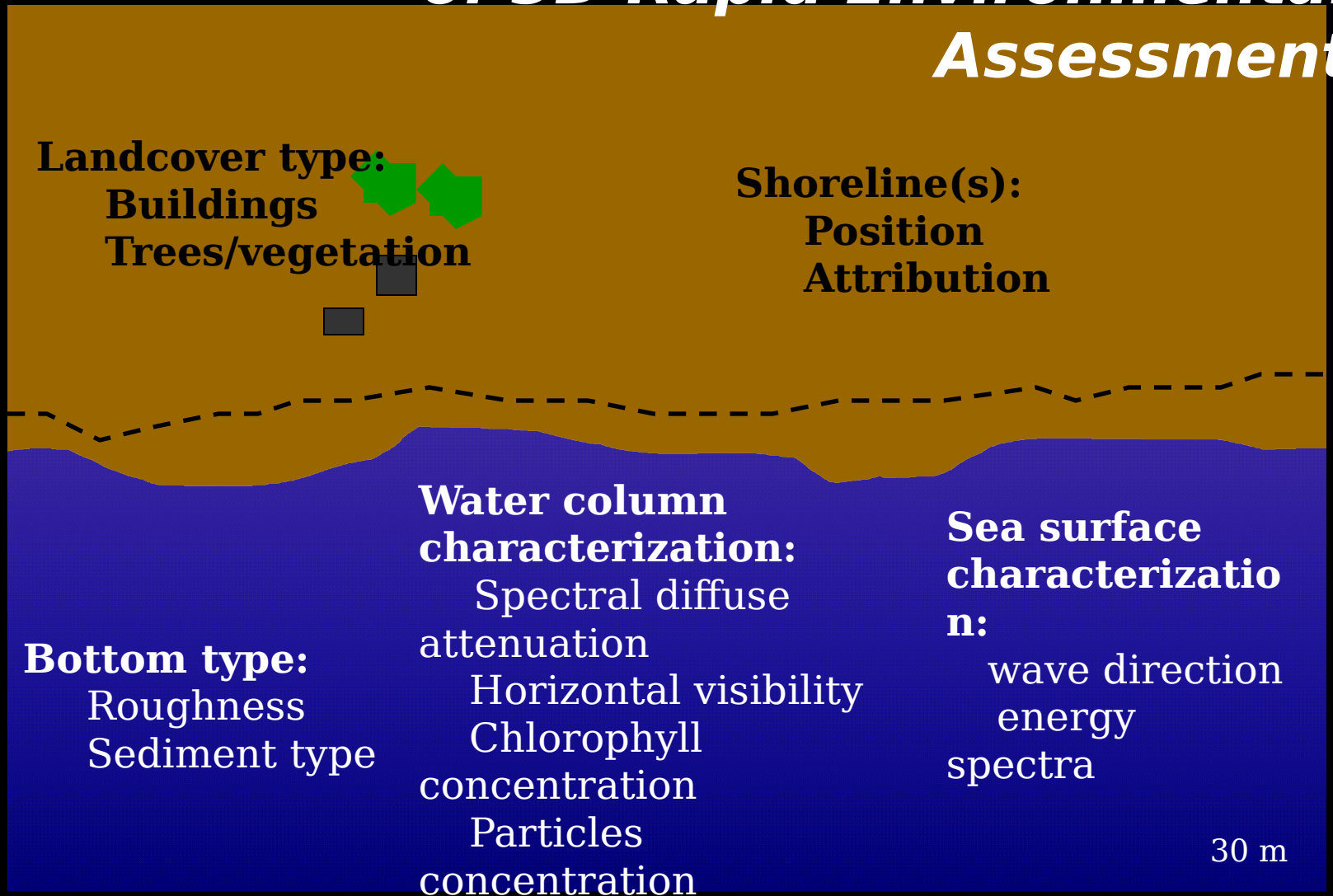
CHARTS is the first system capable of 3D Rapid Environmental Assessment



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NOPP FY06 Annual Report

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6. Impact and Applications
7. Transitions
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1. Project GOALS

1. Establish collaboration between industry and academia on application of data fusion techniques to coastal mapping problems
2. Develop a data fusion paradigm to compare and contrast different data fusion strategies
3. Develop higher-level approaches to data fusion
4. Collect and disseminate datasets supporting research in the broader community
5. Study regional scale coastal environmental problems using data fusion techniques

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2. Project OBJECTIVES

1. Develop new data fusion algorithms to produce coastal and environmental information from SHOALS-1000 data
2. Achieve increased accuracy in environmental parameters through use of in situ datasets
3. Transfer knowledge from academia to industry on collection and use of in situ data
4. Transfer knowledge from industry to academia on collection and use of lidar and hyperspectral data, and in data fusion
5. Educate future workforce through integration of these concepts into courses at USM

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3. Approach and Work Plan

Requested funding: $200K for 3 years

Principal Investigator	Institution	FY05 funds requested	FY06 funds requested	FY07 funds requested
Grady Tuell (lead PI)	Optech International	$135,507*	$137,086*	$135,105*
Steve Lohrenz (co-PI)	University of Southern Mississippi	$64,493	$62,914	$64,895

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	YEAR 1	YEAR 2	YEAR 3
Task 1: collect and use in situ optical data to improve data fusion	Collect airborne SHOALS dataset with simultaneous *in situ* optical data Refine algorithms for computing active and passive bottom reflectance	Collect airborne SHOALS dataset with simultaneous *in situ* optical data Refine algorithms for computing active and passive bottom reflectance	
Task 2: Develop IDL software for high-level fusion	Identify and implement feature extraction procedures for SHOALS pseudoreflectance. Implement feature space segmentation procedure for pseudoreflectance	Identify and implement feature extraction procedures for spectral data Identify and implement inference technique for identity declaration	Refine and implement inference technique for declaration Identify and implement cognitive technique for declaration
Task 3: develop IDL fusion code for topo applications	Generate IDL code to merge topo and bathy data and autoextract	Identify and implement techniques for classification of	Refine shoreline classification. Identify and explore GIS strategies

	FY05	FY06	FY07
Task1	**$97,400.75**	**$80,760.45**	**$2,506.90**
Task2	**$57,695.85**	**$59,406.65**	**$119,549.10**
Task3	**$44,903.40**	**$59,832.90**	**$77,944.00**

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4. Work Completed

1. Collect and distribute datasets
   - Airborne data (page 4)
   - In situ data (page 5)

2. Develop High-level Data Fusion Algorithms for Bathymetric Lidar and Spectral Data
   - Higher-levels on the information axis (page 12)
   - Higher-levels on the spatial axis (page 15)

3. Develop High-level Data Fusion Algorithms for Topographic Lidar and Spectral Data
   - Topographic reflectance from SHOALS (page 20)
   - Topographic classification (page 22)
   - Shoreline extraction and attribution (page 27)

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5. Results

1. Organized and processed data from Optech International's archive

2. Acquired new equipment and developed new algorithms and software for measuring in situ data **Chen**

3. Refined the SIT model and used it to compare and contrast 5 data processing scenarios **Park**

4. Conceived and implemented 3 higher-level fusion algorithms

5. Developed a procedure to auto-extract and auto-attribute shoreline vectors **Raber**

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6. Impact and Applications

1. National Security
   - Data fusion algorithms for finding mines in the coastal zone
2. Economic Development
   - Data fusion algorithms for implementation in commercial airborne remote sensing systems
3. Quality of Life
   - New approaches to mapping and monitoring coastal health, fish habitat, and coral reefs
4. Science Education and Communication
   - Facilitate development of unique academic program in application of bathymetric lidar and data fusion

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7. Transitions and related programs

1. All software and algorithms have been delivered to JALBTCX for use with CHARTS data

2. Datasets used by NAVO to validate satellite bathymetry algorithms

3. SIT data fusion model adopted as a management tool in Optech International's CLUBS project (sponsored by ONR)

4. The resulting partnership between Optech International and USM has lead to a new program to develop the next generation of bathymetric lidar technology: CZMIL

Roman

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Work for Year 2

- Refine and automate Dempster/Shafer algorithm for benthic classification
- Explore application of rule-based approach to benthic case
- develop memory management strategies
- Refine and automate topographic classification algorithms
- Explore Dempster/Shafer approach for topo classification
- Conduct accuracy assessments
- Use standardized classification schemes
- Improve vectorization of shoreline
- Couple code into REA processor
- Improve ability to measure in situ data
- Conduct campaign to collect data
- Publish papers

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